DOCUMENT RESUME

ED 130 807 RC 009 472

AUTHOR Jurik, Richard A.
TITLE The Outdoors: An Environmental Condition to Nurture Creative Thinking.
PUB DATE Mar 72
NOTE 99p.; M.Ed. Thesis, Pennsylvania State University
AVAILABLE FROM Inter-Library Loan, Pennsylvania State Univerity, University Park, Pennsylvania 16802

EDRS PRICE MF-$0.83 HC-$4.67 Plus Postage.
DESCRIPTORS Activity Units; Art Activities; Comparative Analysis; *Creative Thinking; *Creativity Tests; Discovery Processes; Elementary Education; Elementary School Science; *Environmental Influences; *Grade 6; Learning Activities; Literature Reviews; Masters Theses; Music; Nature Nurture Controversy; *Ortdoor Education; Social Studies; Test Reliability; Test Validity; Thought Processes
IDENTIFIERS Torrance Tests of Creative Thinking

ABSTRACT

The study determined whether using outdoor experiences as a teaching medium increased the level of creative thought for sixth grade children. Four factors of creativity were measured: figural fluency, figural flexibility, figural originality, and figural elaboration. Two groups of sixth grade pupils, one experimental (with 30 children) and the other control (with 25 children), were used. Both groups were tested at the beginning of the experiment, using the Torrance Tests of Creative Thinking. The experimental group experienced 13 outdoor education activities incorporated into units within the curriculum areas of social studies, science, art, and music; the control group had no outdoor education activities. After 45 school days both groups were given the Torrance Tests of Creative Thinking. The tests measured nonverbal creativity. Findings included: outdoor education activities did not improve the level of measured creative thinking factors of the experimental group; pupils in the control class signignificantly increased in figural originality and elaboration; outdoor education activities had an effect in nonverbal creativity of girls in the experimental class but not of boys; and boys in the control class had no significant gains in the four measured creativity factors while the girls had a significant gain in figural originality and elaboration. (NQ)

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ED130807

The Pennsylvania State University

The Graduate School

College of Health, Physical Education, and Recreation

The Outdoors: An Environmental Condition to Nurture Creative Thinking

A Problem in

Recreation and Parks

by

Richard A. Jurik

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Master of Education

March 1972

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R000947

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CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

Environmentalists and conservation advocates express a deep concern over the impact of technology and man's disconcern on the earth's ecology--the invisible web of life--which threatens the existence of life itself. David Perlman speaking out for an America the beautiful says:

> Everywhere are the works of modern man, yet all his technology are products of the same genius that created the spaceship's perfect environment--has neither created a fit environment for the human community nor preserved the precious diversity and plenty of the other organisms with which man shares this planet. (20:25)

The threats are serious, the potential losses are critical, and the need for action is urgent. The deteriorating quality of American life can be documented in the countryside and in our cities in aspects such as: the vanishing wilderness, pollution, endangered wildlife, smog, urban sprawl, and "uglification." Action must come from a responsible, enlightened, and active citizenry who possess an environmental conscience and a high level of creativity. To keep the action ongoing, we must take the desired citizenry through the educational processes, and begin with the elementary school age child. Creative thinking development must be an integral part of the elementary school child's developmental program.

Legitimate concerns of education about creativity rest on fully functioning persons, mental health, educational achievement, vocational

success, and social importance (30). Schools have a tendency to develop talents such as memory, I Q, and athletic ability; now, another part of the complex intellect, creative talent, must be developed. Some evidence (9) concerning the relationships between creativity and mental health exists and points out that the stifling of creative desires and abilities cuts at the very roots of satisfaction and ultimately can create overwhelming tension and breakdown. Recent experiments (14, 15) suggest that many things can be learned more economically in a creative situation than in an authoritarian one and that some people who learn little by authority can learn much creatively. Creative thinking is important in success even in some of the most common occupations, such as selling in a department store (35). Schools are concerned that their students make useful contributions to society and to national goals. The future of civilization depends upon the quality of the creative imagination of our next generation (30).

Torrance recognized the importance of creative thinking (creativity) and the school's function when he stated:

> It is assumed that the development of creative thinking is important from the standpoint of mental health, the acquisition of knowledge, the application of knowledge for successful living and professional performance, and the progress of civilization. Also that all individuals to some degree possess the abilities involved in being creative, that these abilities can be improved through education, and that it is the school's function to provide such training. (29:46)

Taylor and Holland furthered the argument for fostering creativity when they stated:

> One of the greatest potential strengths of our nation lies in fostering creativity in all areas of our culture. Creative thinking is needed in many fields besides the arts and sciences; administration and leadership, political science and international diplomacy, accounting, health research and practices, old age problems, reduction of juvenile delinquency and crime, etc. In principle, creative performance can occur in any area of human endeavor. (26:47)

Studies by Torrance and associates (31) contend that creative thinking can be improved through education, but the task at hand is more understanding in the use and selection of tools, methods, and settings to foster creativity.

Individuals desiring to foster creativity express interest in making man a more productive thinker by all the means at their command. This must include developing a creative climate internally, as provided by an individual's attitudes, skills, and knowledge, and externally as provided by his environment (18).

Outdoor education offers a unique opportunity for introducing more first hand creative experience into the regular school curriculum. Educators widely agree that this needs to be done, for participation is the key to true learning. There may be no richer learning environment than the outdoors, natural or man-made. However, educators should be attempting to teach about the "total environment," to teach about the total relationship between man and the world, and to set conditions to facilitate and foster creative thinking. One of the ways to develop these concepts is through outdoor education.

Statement of the Problem

The purpose of this study was to determine whether the utilization of outdoor experiences as a teaching medium would increase the level of creative thought for sixth grade children.

It was hypothesized that outdoor education activities incorporated across the continuum of the school's curriculum increases children's creativity factors of figural fluency, flexibility, elaboration, and originality, and this increase in creativity is significant when compared over the same period of time to children who had no planned outdoor education activities.

Definition of Terms

To afford clarity and understanding the following terms are defined as they were used in the context of this study.

Creativity is a process by which one brings into being a new idea, product, or process, and according to the creator there is no identical twin to his creation.

Outdoor education is learning taking place in an outdoor setting, away from the confines of a classroom where natural and man-made environments make understandings and concepts more meaningful to the learner.

Torrance test of creativity (figural tests) is a series of tasks: picture construction, picture completion, parallel lines, and circles, to measure fluency, flexibility, originality and elaboration.

Delimitations

This study was delimited to two classes of heterogeneous level six children in the Mt. Lebanon School District of which one was designated as control and the other experimental. The number of children, sex ratio, and intelligence level in the control and experimental classes were limited according to the school district's heterogeneous homeroom assignment policy.

The only factors of creativity which were measured were: figural fluency, figural flexibility, figural originality, and figural elaboration, as presented in the Torrance Tests of Creative Thinking.

Limitations

1. The experimental variable was the incorporation of outdoor environmental experiences into selected daily lesson plans taught to the experimental class. The activities were not directed specifically toward enhancement of creativity but toward the lesson's primary objective.

2. Exposure to the experimental variable was during one report period only consisting of nine weeks. The sufficiency of this length to affect change in creativity level is not known.

3. The degree of creativity was determined only by the Torrance Tests of Creative Thinking.

CHAPTER II

REVIEW OF LITERATURE

This chapter is divided into two parts: (a) related research which deals with studies on environmental conditions that affect creativity, and (b) discussion on creativity which describes primarily the nature and assessment of creative behavior.

PART I: RELATED RESEARCH

Because there are many relevant variables, it is difficult to categorize the literature regarding environmental conditions affecting creativity. Therefore, only those studies relating to outdoor education are discussed in this chapter.

The bibliography section of Parne's Creative Behavior Guidebook, Section II Bibliography under the subheading "References and Research Abstracts" contained 228 citations pertaining primarily to educational programs and environmental conditions designed to nurture creative behavior. Most of the citations were for the period of the 1960's. Not one dealt with either an outdoor setting or an outdoor education program. Parnes (19) did indicate that his study of research had revealed evidence that environmental factors seem to influence creative behavior even though the outdoors is not specifically included.

Bibliographies for "Camping" or "Outdoor Education" research have no studies identified as relating to creativity. One title had

in it the word creativity. This was misleading because upon examination the study did not deal with creativity in the usual meaning of the term.

Britton's study (2), although not related to an outdoor setting nor outdoor education, appeared somewhat related. His purpose was to determine whether selected learning experiences would increase the level of creative thought in certain sixth grade children. Britton stated that the following results were significant:

1. The total scores of each of the variables fluency, adequacy, and flexibility indicated a significant advantage for the experimental group over the control group in the verbal area.

2. The total scores of each of the variables originality, elaboration, fluency, and flexibility revealed a significant gain in favor of the experimental group over the control group in the non-verbal area.

3. There was no significant difference between the experimental and the control group on either originality or elaboration in terms of improvement of verbal creativity.

4. There was no significant difference between the experimental group and the control group on activity or on title adequacy in terms of gains in non-verbal creative ability.

5. The boys in the experimental group made greater gains than the boys in the control group in both the total verbal and the total non-verbal areas.

6. The girls in the experimental group did significantly better than the girls in the control group in terms of non-verbal creativity but there were no comparable differences in the verbal area. (2:74-75)

Britton also concluded that the provisions of selected learning experiences did improve the level of creative thinking of the pupils in the experimental groups.

The improvement in the level of creative thinking through Britton's experiment gave confidence that outdoor experiences will increase the level of creativity in the children in this study.

PART II: NATURE AND ASSESSMENT OF CREATIVE BEHAVIOR

Although creativity had been a concept of some interest throughout the history of man, creative talent had many times gone without honor because the creative person had been "before his time." As Toynbee (34:4) so aptly stated, "If the people have no vision, the prophet's genius, through no fault of the prophet's own, will be as barren as the talent that was wrapped in a napkin and was buried in the earth," The noted British scientist Hoyle, as quoted by Toynbee, stated, "The nation that neglects creative thought today will assuredly have its nose ground into the dust of tomorrow." (34:5)

From about 1880 to 1950 there was only a trickle of research articles on creativity in the scientific literature. In fact, none of the earlier contributors to research concerning creativity in education manifest sustained interest. Since 1950, however, interest and activity have increased tremendously and opened many avenues of research as indicated by the number and quality of projects undertaken (25). Some governmental agencies such as the Air Force, Army, and Space Administration; private corporations, such as Dow Chemical and Western Electric; and universities have shown a sustained interest in research activities on creativity (30).

Centers for Creative Research on University Campuses

Research activities, primarily on university campuses have made significant contributions to the concept of creativity. Relevant contributions from Guilford and his associates (9) at the University of Southern California, primarily through his "Structure of Intellect,"

resulted in tests devised to measure the different thinking abilities represented in this "Structure of Intellect" that being divergent production used extensively for predicting creative thinking. Long a leader in research on creativity in art education, Lowenfeld at The Pennsylvania State University turned his attention during the last years of his life to the interdisciplinary aspects of creativity in education (30). Considerable influence of creativity research upon education has been felt through the five national invitational conferences in 1955, 1957, 1959, 1961, and 1962 at the University of Utah under the direction of Taylor (30). Centers for research on creativity have also been established at the University of Buffalo under the direction of Parnes (16) testing Osborn's principle of "brainstorming." The University of Chicago breakthroughs came from the work of Getzels and Jackson (5) concerning "creativity as a type of giftedness" that contributes to educational achievement. At the University of Illinois Gallagher (22) studied the productive thinking of gifted children in the classroom, and Suchmann (23) developed techniques for teaching children inquiry skills. Research at the University of Minnesota under the direction of Torrance (33) contributed instruments for assessing the creative thinking abilities at all levels of education from kindergarten through graduate school, plotting of the developmental nature of the creative thinking abilities including cross-cultural studies, and studying of conditions affecting creative growth including both factors that can be manipulated in the classroom and laboratory and factors that originate in nature and society. Other centers for

creativity research are Ohio State University, University of Texas, University of California at Los Angeles, Teacher's College Columbia University, University of Delaware, New York University, and Harvard University.

Reasons for Interest in Creativity

If creativity was a phenomenon that existed through the ages, why did it come to the forefront as something desirable and not one of suspicion? Guilford (7), for one, listed the following reasons for interest in creativity: military for stepped up rate of inventions, boredom due to more leisure time, and space age for new inventions. Parnes and Harding (17) felt the brains race with other known world powers as another major contributor to increased creative research activity. In 1953 Thurstone (27) advocated an aggressive front in the identification of creative talent and in the training and encouragement of such talent. Taylor (25) stated that in all fields of endeavor the creative talent is the one most actively sought especially in the scientific fields since our present day culture places such high emphasis on scientific achievements. Torrance (29) so aptly stated that creative thinking was important from the standpoint of mental health, the acquisition of knowledge, the application of knowledge for successful living and professional performance, and the progress of civilization. Torrance (29) also stated that all individuals to some degree possess the abilities involved in being creative, that these abilities can be improved through education, and that it is the school's function to provide such training.

Concept of Creativity

Creativity is as difficult to define as intelligence is and there seems to be no universal agreement on a working definition. Getzels and Madaus stated that definitions are formulated in terms of:

> A manifest product: it is novel and useful. An underlying process: it is divergent yet fruitful. A subjective experience: it is inspired and imminent. (6:267)

Some sample definitions from the Utah conference series compiled by Taylor:

> Ghiselin proposes that the 'measure of a creative product be the extent to which it restructures our universe of understanding.' Lacklen, of the Space Agency, uses 'the extent of the idea of science that the contribution underlies--the more creative the contribution, the wider its effects.' Sprecher is interested in the novelty and the value of scientists' ideas, and in their work habits as well; he is also concerned about differences in opportunity to be creative in different work situations. The working definition of creativity used by Stein is that a process is creative when it results in 'a novel work that is accepted as tenable or useful or satisfying by a group at some point in time.' (25:6)

Thurstone (28:35) defined creativity as an experience: "characterized by the moment of insight which is often preceded by non-verbalized prefocal thinking." On the other hand Torrance expressed his definition of creativity as a process:

> whereby one becomes aware of problems; searches for clues, formulates hypotheses; tests these hypotheses; and communicates the results. (33:11)

It is clear that no single definition has yet been prepared that suits all workers in the field. One may choose tentatively an existing definition of creativity or may develop a definition of his own that will enable him to move ahead in his work.

The Creative Process: How Does a Person Produce Something New?

The creative process seems to be essentially the same regardless of the activity. Youtz (36) reported that Wallas in The Art of Thought set a general framework of creative activity with the steps being: "Preparation," "Incubation," "Illumination," and "Verification."

Torrance (29) followed much of Wallas' general framework of creative activity except Torrance added a step before "Preparation" that being "sensing and clarification of the problem" and he made no reference to "Incubation."

When Torrance's and Wallas' framework or steps are combined, we have the following to describe the creative process:

First, sensing the problem: there is the sensing of a need or deficiency, random exploration, and a clarification or pinning down of the problem.

Second, preparation: there ensues a period of preparation accompanied by reading, discussing, exploring, formulating many possible solutions, and critically analyzing these solutions for advantages and disadvantages.

Third, incubation: the interval between the time when the person has completed preparation and illumination occurs. The interval of time can vary from minutes to months. This is an active period, although the person does not report much conscious activity.

Fourth, illumination: out of all the previous activity comes the birth of a new idea--a flash of insight. All the parts fall into a pattern that looks as if it would be successful.

Fifth, verification: this is the process of trying out and testing the good idea.

> The creative process was defined by Rogers as: "It is the emergence in action of a novel relational product, growing out of the uniqueness of the individual on the one hand, and the materials, events, people, or circumstances of his life on the other." (21:65)

Factors Exhibited in the Creative Process

Intellectual and emotional factors found to be exhibited in the creative process were compiled by Arnold (1):

Intellectual factors or attributes:

1. Fluency--more ideas per unity time and the ideas cover a greater range of human experience. Fluency is the result of one being able to momentarily reserve or withhold judgment. One lets his ideas flow uninhibited, and at a later time make judgments and evaluations.
2. Flexibility--facilitiated by having a great many tricks in your bag, knowing lots of techniques, having broad experiences, and being a participator in the creative act and at the same time being an observer on your own participation.
3. Problem Sensitivity--having an awareness of problems and the ability to verbalize this awareness into a problem statement.
4. Originality or Novelty--bringing together seemingly disparate ideas to form this new totality.

Emotional factors or attributes:

1. A sincere desire to help mankind.

2. A feeling and belief that all of man's accomplishments to date can be improved and one must have confidence in himself as one qualified to bring about these improvements.
3. A willingness to gamble, to take a chance, and the energy to carry the new idea through.

Nature of the Creative Person

Traditional measures used to identify the creative person have proved to be of little or no value. School grades as a measure had little or no validity since academic performance usually involved so much that is noncreative (26). Evidence suggested that intelligence tests are not very effective measures of creative potential; intelligence, as measured, accounts for only a small part of the variation in creative performance (5). There is little relationship between creative performance and the sheer accumulation of knowledge. There are many examples of people in the academic world who are well versed in their discipline but who have demonstrated little creativity (26).

Intellectual characteristics that appeared to have a relationship with creative performance fell with Guilford's (9) "Structure-of-Intellect" categories of cognition, memory, divergent production, convergent production, and evaluation. The divergent production factors most likely to identify creative talent are: adaptive flexibility, spontaneous flexibility, associational fluency, expressional fluency, word fluency, ideational fluency, originality, redefinition, elaboration, and some evaluative factors (26). Knowledge, facts, concepts, understandings, and skills learned through convergent thinking processes are

put to new uses by the creative thinker. Creative thinkers tend to sense gaps in information or disharmonies among facts (22). Persons identified as creative through divergent thinking tasks tend to have more ability and a greater tendency to toy with ideas plus solutions rather than cursing at gadgets that presented problems (26).

Personality characteristics of the creative individual have shown that they are: more autonomous than others, more self-sufficient, more independent in judgment, more open to the irrational in themselves, more stable, more capable of taking greater risks in the hope for greater gains, more feminine in interests and characteristics, more dominant and self-assertive, more complex as a person, more self-accepting, more resourceful and adventurous, more radical, more self-controlled, more emotionally sensitive, and more introverted but bold (26).

Motivational characteristics that tend to describe the creative individual are curiosity or inquiringness of mind, liking to think, liking to manipulate and toy with ideas, intellectual persistence, need for recognition for achievement, need for variety, need for preference for complex order and for challenges, tolerance for ambiquity, resistance to closing up and crystallizing things prematurely coupled with a strong need for mastery of a problem, and a need to improve upon correctly accepted orders and systems (24). They are more interested in and aware of unconventional careers (26).

Basic Principles of Creativity

Smith, author of six volumes in creative teaching, had summarized the knowledge being accumulated in the area of creativity into the following fourteen basic principles:

1. All children are born creative.

2. There is a relationship between creativity and intelligence; highly creative people are always highly intelligent although highly intelligent people are not always creative. However, all children can create to some degree.

3. Creativity is a form of giftedness that is not measured by current intelligence tests.

4. All areas of the curriculum may be used to develop creavitity.

5. Creativity is a process and a product.

6. Creativity is developed by focusing on those processes of the intellect which fall into the general area of divergent thinking. This area of the intellect has been greatly neglected in our teaching up to this point.

7. All creative processes cannot always be developed at one time or in one lesson. Lessons must be planned to focus on each process.

8. Creativity cannot be taught; we can only set conditions for it to happen and insure its reappearance through reinforcement.

9. More knowledge, more skills, and more facts than ever before are required in order for creativity to be developed.

10. The theories of creative development lead us to believe that children must be able to tap all of life's experience in order to become truly creative--unnecessary rules and actions may force much of their experience into the preconscious or subconscious, where it cannot be readily used.

11. Excessive and/or compulsive conformity and rigidity are true enemies of creativity. The creative person is neither compulsively conforming nor compulsively nonconforming. He is free to conform or not conform in terms of what he believes to be true, right, effective, or best for the situation.

12. Children go through definite steps in the creative process.

13. Creative teaching and creative learning can be more effective than other types of teaching and learning. They are especially effective for certain kinds of children, among them those who do not seem to learn well by other methods.

14. Children who have lost much of their creativity may be helped to regain it by special methods of teaching. (22:17)

Assessment of Creativity

Establishing a reliable criteria to identify creativity has been the critical issue underlying all work in the field of creativity. Among the most common criteria have been the following:

1. Achievement. An attempt is made to identiiy achievements which speak for themselves.

2. Ratings. It is assumed that a person who has had an opportunity to observe another person can provide a sound judgment of his inventiveness.

3. Intelligence. Performance on intelligence tests is the most widely used and best-validated index of mental functioning.

4. Personality. Characteristics of personality are evaluated in relation to an empirically derived or a priori profile of the "creative personality," and the closeness of the fit is used as a criterion.

5. Creativity-test scores. Although attempts to measure aspects of creativity through tests have a long history, the factor-analytical studies by Guilford inspired the great variety of so-called creativity tests not only in his terms but in related principles as well. (6:272)

Many predictor instruments have been devised to identify creativity within an individual. To determine their worth a review of the predictors in concurrent validity studies are given:

1. High level aptitude tests such as Guilford's battery of aptitude tests devised to measure creativity have had only modest success (26). Most studies suggest that the relation of intelligence tests to creative performance is generally

low (.20 to .40) in unselected populations and is zero and even negative in homogeneous samples at high levels of intelligence (12, 11).

2. Motivation and interest inventories, with a few exceptions, typical interest inventories, have been poor predictors (26). Holland (11) found simple interest measures to be among the best predictors of creative performance.
3. Biographical information, such as simple check list of background, preferred activities, expressed goals, and levels and kind of desired attainment have produced predictors of unusual validity even in cross validation (.30 to .55) (26).
4. Personality and originality scales such as the California Personality Inventory and Saunder's Experimental Personality Research Inventory is generally low (26).
5. Self-ratings being simple self-ratings by adolescents and adults have moderate validity for a variety of creative performances (26). No study reported on the elementary school age child.
6. Ratings by others such as teacher ratings appear to be of little value for predicting creative performance (26).
7. Special devices and tests have been under investigation and are reported as unique, but no evidence for the validity of some of these techniques is available. Some new tests by art educators may have merit (26).

8. Physical measures and effects of drugs, especially certain drugs that produce interesting reactions have been studied in connection with creativity. No conclusive results on their contribution to identifying the creative person have been established (26).

9. Situational influences such as attitudes reported by parents through the Parental Attitude Research Instrument developed by Schaeffer and Bell were found to be related to the creative performance of adolescents at a very low but significant level of correlation (26).

Taylor and Holland in their discussion for predictive studies stated:

> Predictive studies are the only way we have to acquire valid information which will enable us to identify those adolescents who will become creative scientists. Concurrent-validity studies of tests and the use of test scores as criteria are useful intermediate steps; they help us to obtain a wide array of potential predictors. But from studies of various occupations, comparisons between concurrent and predictive validation of the same predictors suggest that a substantial number of predictors that look promising in concurrent-validity studies do not, in fact, hold up when their predictive validity is checked.
>
> The use of scores on any particular test as a criterion of creativity is fraught with similar difficulties. Tests developed to measure creativity generally lack social relevance. Even if we can predict these tests scores from other scores also designed to measure creativity, we are still faced with the problem of whether scores on these creativity tests have any real-life significance. (26:48)

Measuring Creativity Through Tests

Methods of measurement during the elementary school period had incorporated varied materials and tasks in assessing the creative

capacities of children (30). Some of the tests which had been used to predict creativity in children and adults are the following: 1902 Colven's Compositions; 1922 Simpson's Sets of Four Small Round Dots; 1927 Abramson's Inkblot Tests; 1933 Grippen's Verbalization While Painting; 1939 Harm's Drawing Lines to Represent Words; 1948 Vernon's Imaginative Construction Test; 1949 Stephenson's Poetry Writing and Art Form Test; 1951 Guilford's Factor Tests; 1958 Getzels and Jackson's Make-Up Problems; 1958 John's Problem Solving Apparatus; 1958 Flanagan's Ingenious Solutions to Problems Test; 1961 Holland's Simple Interest; 1964 Mednick's Remote Association Test; 1966 Torrance Tests of Creative Thinking.

Factor Analysis Led to New Tests

Guilford's conceptualization of creative thinking and his battery of tests remained at the core of most recent instruments including Torrance Tests of Creative Thinking. Guilford's (8) factor analysis produced seven factors or distinct abilities of individuals in their creative thinking; they are the following:

1. Fluency--the rate at which ideas are produced. These four abilities are regarded as kinds of fluency: Word fluency--the ability to think of words rapidly. Ideational fluency--the rapid listing of meaningful ideas in a specified category. Associational fluency--the ability to produce a variety of meaningful correlates. Expressional fluency--the ability to put words into organized phrases and sentences.

2. Flexibility--some individuals are rigid or set in their thinking; they should strike out in new directions. These two abilities are regarded as kinds of flexibility: Spontaneous flexibility--the thinker is flexible even when he has no need to be; jumping from one category to another is an indication of spontaneous flexibility. Adaptive flexibility--the thinker would fail to solve a problem if he were not flexible.
3. Sensitivity to problems--individuals who are more alert to the existence of problems have occasion to go to work upon them, and if they do, they have increased probability of coming up with solutions.
4. Originality--the ability to generate new ideas and to produce a variety of transformations. Elaboration is in this category.
5. Analyze information--the ability to separate objects or ideas into its parts. Analytical results indicate that each person is not at all uniformly able to analyze in all situations and with all kinds of materials. Abilities to perform in tests involving analyzing are general aptitudes of various kinds, depending upon the task.
6. Synthesize information--the ability to put the same old elements together in some new way.

7. Redefinition--the ability to transform the meaning, use or function of an object so as to give it a new role. These three abilities are regarded as kinds of redefinition: Semantic redefinition--changing the meaning of an object or part of it in order to adapt it to some new use; Symbolic redefinition--giving sentences in each of which the name of a sport or game is concealed. Familiar words must be broken down and the letters regrouped in order to answer the items; Figural redefinition--lines that function in certain ways in a complex figure must be given new functions as they become parts of new figures.

Elements and Procedures That Could Foster Creativity

Based upon research in the area of creativity, Smith formulated 18 principles for creative teaching:

1. In creative teaching something new, different or unique results.
2. In creative teaching, divergent thinking processes are stressed.
3. In creative teaching, motivational tensions are a prerequisite to the creative process. The process serves as a tension relieving agent.
4. In creative teaching, open-ended situations are utilized.
5. In creative teaching, there comes a time when the teacher withdraws and children face the unknown themselves.
6. In creative teaching the outcomes are unpredictable.
7. In creative teaching, conditions are set which make possible preconscious thinking.
8. Creative teaching means encouraging children to generate and develop their ideas.
9. In creative teaching, the process is as important as the product.

10. In creative teaching, differences, uniqueness, individuality, and originality are stressed and rewarded.

11. In creative teaching, certain conditions must be set to permit creativity to appear.

12. Creative teaching is success--rather than failure--oriented.

13. In creative teaching, provision is made for learning many knowledges and skills, but provision is also made to apply these knowledges and skills in new situations.

14. In creative teaching, self-initiated learning is encouraged.

15. In creative teaching, skills of constructive criticism and evaluation are developed.

16. In creative teaching, ideas and objects are manipulated and explored.

17. Creative teaching employs democratic processes.

18. In creative teaching, methods are used which are unique to the development of creativity. (22:9-14)

Torrance formulated 20 tentative principles to aid teachers to develop creative thinking in children through the children's school experiences. These ideas have been borrowed from many sources: Torrance and associates' research in the Bureau of Educational Research at the University of Minnesota, Torrance's own experiences, and cumulative research which has been conducted by others in the field of creativity. Torrance's 20 tentative principles are:

1. Value creative thinking.

2. Make children more sensitive to environmental stimuli.

3. Encourage manipulation of objects and ideas.

4. Teach how to test systematically each idea.

5. Develop tolerance of new ideas

6. Beware of forcing a set pattern.

7. Develop a creative classroom atmosphere.

8. Teach the child to value his creative thinking.
9. Teach skills for avoiding peer sanctions.
10. Give information about the creative process.
11. Dispel the sense of awe for masterpieces.
12. Encourage and evaluate self-initiated learning.
13. Create "thorns in the flesh."
14. Create necessities for creative thinking.
15. Provide for active and quiet periods.
16. Make available resources for working out ideas.
17. Encourage the habit of working out the full implication of ideas.
18. Develop constructive criticism not just criticism.
19. Encourage acquisition of knowledge in a variety of fields.
20. Develop adventurous--spirited teachers. (29:46)

Even though there appears overlapping in Torrance's and Smith's principles, they serve as valuable guidelines to foster creativity.

Training Methods to Stimulate Adult Creativity

There are training methods now in use to stimulate adult creativity. Most adults reach maturity with much of their creative potential buried as a result of their educational and social experiences. The creativity--training programs for adults are attempts to overcome previous deficiencies in education and training. Some of these problem solving approaches with adults may be utilized with some modifications with children.

Training programs that have been tried with adults are classified and briefly described as (13):

1. Development of sensitivity to problems--gives students experience in locating problems such as actual visitations to industrial firms to locate problems, meeting with business executives to discuss a general problem, studying production facilities to locate problems, and studying "idea books" which record the ideas or problems in research laboratories.
2. Attribute listing--involves looking at all aspects of a situation. By progressive examination and then listing of the desirable and undesirable attributes of the various aspects of the problem, the solution is reached.
3. Morphological analysis--proposed by Zwicky involves combining the major attributes of the major variables of a problem into a grid so that all possible combinations can be considered. This technique stirs the imagination by enabling the individual to focus on one aspect of the situation at a time.
4. Brainstorming--proposed by Osborn involves expressing ideas readily, spontaneously, and uncritically until a quantity of ideas is available to be judged. This approach is to free the individual from the effect of using critical judgment prematurely.

5. Synectics--involves the use of "operational mechanisms" to help produce four mental states. The mental states being: (1) "Detachment-involvement" is removing a problem from its usual context to see it differently, and become involved with it to develop new insights. For example, how would you feel if you were a nail. (2) "Deferment" is resistance to the first solution that comes to mind in favor of waiting for a better one to come along. (3) "Speculation" is permitting the mind to run free. (4) "Autonomy of the Object" is when ideas about the solution of a problem seem to crystallize and develop a life of their own.

The four "operational mechanisms" purposes are to make the familiar strange and the strange familiar. The four "operational mechanisms" are:

a. "Personal Analogy" imagining how one would react if one were an atom.
b. "Direct Analogy," studying the way a clam opens and shuts to design a self-closing container.
c. "Symbolic Analogy," making a comparison with the Indian rope trick in the process of designing a jack.
d. "Fantasy," the free and whimsy use of imagination.

6. Drugs--involve experimentation with chemical compounds found free in nature and chemically compounded in a laboratory. "L S D" was a result of drug experimentation.

Parnes (19) had compiled and annotated 27 methods and educational programs for stimulating creativity.

Assuming the statements on the nature and assesement of creative behavior to be correct, it appears that the educators in public schools should search for methods, tools, and settings to nuture creativity.

CHAPTER III

PROCEDURES

The purpose of this study was to determine whether the utilization of outdoor experiences as a teaching medium would increase the level of creative thought for sixth grade children. The effect of the experience was judged in terms of non-verbal activity differences between two sixth grade classes in relation to gains made in ability to do creative thinking between the experimental and control classes after the experimental class had been exposed to outdoor education activities.

Procedures for the study are discussed under four headings: 1. Subjects--the children having outdoor education experiences and the children not having outdoor education experiences. 2. Outdoor education program--the outdoor activities experiences by the children in the experimental class. 3. Creativity tests--the Torrance Tests of Creativity administered in a pre- and post-session. 4. Treatment of data--procedures to determine whether there was a significant change or difference in figural fluency, flexibility, originality, and elaboration in the Jefferson Level Six children after having the outdoor education experiences.

Subjects

The study was conducted with 55 level six children in the Mt. Lebanon School District. The experimental class, Jefferson Level Six, had 30 pupils, 18 boys and 12 girls. The control class, Markham Level

Six, had 25 pupils, 13 boys and 12 girls. The children in the Mt. Lebanon Public Schools are selected for each homeroom assignment by a randomization method set forth by the school district's policy to give each homeroom a heterogeneous character.

The Mt. Lebanon Public Schools has seven elementary schools with thirty level six classes. The control class as a whole was matched as closely as possible to the experimental class in intelligence, sex ratio, socioeconomic background, and the homeroom teacher's teaching method. Therefore, the only randomization in the experiment was the assigning of children to a heterogeneous class.

The teacher variable was significant enough that matching appeared necessary to stabilize this variable. With the aid of two level six teachers and a principal, the control class teacher was matched with the experimental class teacher with the following criteria: a) both would provide a permissive atmosphere, b) both would be non-authoritarian without sacrificing control, c) both would create an educational setting to invite inquiry.

When the control class had been selected, a meeting was arranged with the teacher. At this meeting the teacher was told of the planned study, the purpose of the study, and the procedures to be used in the study. At this time the teacher had an opportunity to refuse participation in the study. The teacher had no duties or assignments to carry out other than promising that the class would not have any outdoor experiences during the study time nor knowingly use a program or method to nurture creativity. The teacher did not administer any of the creativity tests.

..Outdoor Education Program

The study was in progress for 45 school days or the length of the first report period. During this time the experimental class was exposed to outdoor education activities for a total of 24 hours or an average of two hours and 40 minutes per week. The control class, which had no exposure to outdoor education activities, experienced their regular classroom schedule and routine.

The experimental variable consisted of 13 outdoor education activities (see Appendix B) which were part of teaching units within the curriculum areas of social studies, science, art, and music. The outdoor education activities were to give children experiences in the following skills and understandings:

1. In-depth plot study involved the selection of a specific geographic setting to provide the children with an opportunity to experience and apply skills and understandings learned within the school's curriculum.
2. Estimating involved the skill of "rounding numerals" to judge "how many" where exactness was not necessary and also used their skills to judge measurements.
3. Diversity is an ecological concept involving an awareness of the large quantity of different small things which made up the observed environment.
4. Density is the amount of animate and/or inanimate objects counted in the area under observation.
5. Classifying through taxnomic keys. The children identified plants and animals by their physical structure, size and coloration as drawn by an artist.

6. Pollution (its sources, causes, and cures). The overabundance of any unwanted material in a normal or balanced environment.
7. Conservation practices. The children observed and were told of the wise use and management of the natural environment for farming, and forestry.
8. Recycling. The children observed and experimented with matter and found it could be reused for example as in the water cycle, or when decayed plants and animals are used to feed new plants.
9. Sketching and shading with charcoal. The use of this media to put on paper scenes or objects as children saw them in their natural setting.
10. Painting with pastels. Same as #9 above.
11. Making musical instruments from natural materials. The use of this media was to construct string, wind, or percussion instruments. The children played tunes, learned principles of sound, and experienced how their forefathers had to improvise.

The children of each heterogeneous homeroom in the Mt. Lebanon Public Schools are deployed into a homogeneous group for arithmetic and language arts (reading, spelling, writing, and English). Therefore, outdoor education activities could not be planned for these children while they were in the arithmetic and language arts classes.

Thirteen outdoor education activities were experienced at the following sites:

1. Nine activities were within the school grounds. The school grounds consisted of: playgrounds, lawns, trees and shrub areas, football and baseball field and a parking lot.
2. Two activities were at Byrd Park. Byrd Park is a 12 acre community park in its wilderness state with a small picnic area.
3. One activity was at Phipps Conservatory and a Nature Museum. The Conservatory is a well-known attraction in the City of Pittsburgh where visitors can walk through decorative garden arrangements and exotic plant life. The Nature Museum exhibited native wild-life and plants.
4. One activity was at a dairy farm. The owner and a soil conservationist conducted the class on a tour of the dairy farm.

Creativity Tests

The Torrance Tests of Creative Thinking is perhaps the most extensive set of materials for use at all educational levels and, therefore, was chosen for use in this study (See Appendix A). The tests are available through Personnel Press, Inc., a division of Ginn and Company. The present research edition represented nine years of research work done by the author, E. P. Torrance, and probably represents the first time that such tests have even been made available for general research use, at least with children (22).

Torrance Tests of Creative Thinking were developed by Torrance after adapting and modifying Guilford's factor tests during the Minnesota Studies of Creative thinking 1959-62. The Minnesota Studies'

approach differed in two major ways from Guilford's approach, yet makes direct use of Guilford's work. The major differences in the Minnesota Studies approach, as related by Torrance were:

> First, instead of seeking measures to represent single factors, the strategy in the Minnesota Studies has been to develop complex tasks presumed to involve the whole creative process and then to evaluate the products in terms of the kind of thinking or factors manifested. Second, the Minnesota group has tried to build into the tasks and instructions certain features that make use of what we know about the nature of creative thinking. (30:83)

The figural tests which were used in this study involved the following tasks:

1. Picture Construction test requires the children to think and draw a picture in which the given shape made of colored paper is an integral part. They are to think up a title for it. Elaboration is encouraged to add ideas that will make the picture tell as complete and as interesting a story as possible.
2. Incomplete Figures test requires the children to add lines to the incomplete figures sketching some interesting objects or pictures. They are to make up an interesting title for each drawing. This test sets up in the children tensions to complete it in the simplest and easiest way possible. Thus, to produce an original response, he has to control his tensions and delay gratification of this impulse to closure.

3. Parallel Lines test requires the children to make objects or pictures from the parallel lines, and give the picture or objects a name or title. This test taps the ability to make multiple associations to a single stimulus.

For a more in-depth examination of the tests used in this study including a discussion on "validity" and "reliability" (See Appendix A), "Analysis of the Torrance Tests of Creative Thinking."

Most recently Crockenberg (3) wrote that educators were eager for alternative measures of ability other than I. Q. tests, hence the rise of creativity tests. Since many tests were available with similar criteria, Crockenberg discussed only the Torrance and the Wallach and Kogan tests. After completing the discussion on the Torrance Tests of Creative Thinking, Crockenberg made the following statement:

> Clearly, while the validity evidence on the Torrance test is abundant, it is also weak. While we cannot dismiss the Torrance Test, neither is it reasonable to conclude that it is a valid measure of creative process. (3:35)

Crockenberg (3) dismissed the Torrance Tests as a valid measuring instrument based upon the following points:

1. Crockenberg questioned how creative could a child be in a test environment which is reminiscent of classroom test taking such as test booklet, numbered spaces and timing.
2. The test coerces a child to stay with a task he might otherwise leave.

3. There is little evidence dealing directly with the relationship between the various subtests of either the verbal or figural tests. It would appear only the elaboration scores measure something different from the other three scores.
4. Trait consistency across measures was low. For example the scores for fluency varied greatly within the various subtests.
5. Children with high I.Q.'s are more likely to score higher on the Torrance Test than children with lower I.Q.'s.
6. The test-retest reliability coefficients had a wide range.
7. Concurrent validity that was established through Torrance Tests and teacher's ratings on the same characteristics was not consistent.
8. Predictive validity could be considered typical of well-educated high I.Q. people.

Even Torrance would agree the tests are not all inclusive and infallible measuring instruments, however, based upon sound experimental and statistical procedures, the present Torrance test edition represents one of the more favorable instruments. Until the nearly perfect testing procedure for large group school use is devised, then a person who wished to find a method or an environment to facilitate creativity could have reasonable confidence in the results attained from the Torrance Tests.

Administration of the tests requires that the examiner read the directions, set timing, establish a good relationship with the examinee, and motivate subjects to perform at their best.

The figural tasks of the Torrance Tests are presented in different booklets; there is an alternate form for each (A and B). Thirty minutes are necessary for a child to complete one figural test form.

The pre-test, "Thinking Creatively With Pictures," Booklet A, was administered by the teacher of the experimental class to the experimental and control classes the first week school was in session.

The post-test "Thinking Creatively With Pictures," Booklet B, was administered by the teacher of the experimental class to the experimental and control classes at the end of the first nine week report period.

Scoring tests of this sort is difficult. Torrance developed an elaborate scoring guide, giving both rules and examples. Scorers are able to agree rather well with Torrance's judgment of specimen papers, but only after attentive study of the manual. To determine the points assessed to each task the teacher must consult the Directions Manual and Scoring Guide. The scoring guide sets the points assigned to the tasks from which the scorer keeps a tabulation for each activity on a scoring worksheet. The scorer can then put scores into a score summary chart, total the scores to arrive at a total raw score for each of the following factors: Fluency, Flexibility, Originality, and Elaboration.

To get the best possible scoring on the tests used in this study, a contract was made with Personnel Press Scoring Services to have experienced and unbiased test scorers score the tests. The scoring service also calculated the means and standard deviations.

Evaluation for each response of the tests is based upon the following factors:

1. Fluency. The number of relevant responses given minus the number of duplications and irrelevant responses.
2. Flexibility. The number of different categories into which the responses fall.
3. Originality. The frequency with which a response occurs. The less frequent a response, the more originality points it is given. It is heavily weighted on imagination and creative strength showing intellectual energy by being beyond what is learned, practiced, habitual, and common place.
4. Elaboration. The amount of detail given to a drawing to make it more complete of a construct.

   The raw scores for each factor on each task are summed on the scoring sheet.

Treatment of Data

After the Torrance Tests were scored, the means, standard deviations, ranges, and t-values were calculated. These statistical data were used to find the following differences or changes:

1. Difference on experimental pre-test and control pre-test. t-tests were used to determine whether any difference existed between the experimental and control classes in the four measured creativity factors before the Jefferson Level Six Class had experienced the outdoor education activities.

2. Difference on pre- and post-tests between experimental and control tests. Due to the difference between the experimental and control classes at the beginning of the study, a statistical procedure was necessary to equalize the classes and later determine whether any changes actually took place. Rather than use analysis of covariance, Dr. Chauncey Morehouse, The Pennsylvania State University, recommended the following statistical procedure be used. A mean was calculated for the difference in the experimental pre-test and post-test raw scores. A mean was also calculated for the difference in the control pre-test and post-test raw scores. The t-test was run on these means to determine whether any differences or changes occurred between the experimental and control classes in the four measured creativity factors after the Jefferson Level Six Class had experienced the outdoor education activities.
3. Difference on the experimental pre-test and post-test. t-tests were used to determine whether any differences or changes occurred only in the experimental class in the four measured creativity factors after they had experienced the outdoor education activities.
4. Difference on the control pre-test and post-test. The t-tests were used to determine whether any differences or changes occurred in the control class in the four measured creativity factors after they had their regular classroom routines.

5. Difference on boys' (experimental and control) pre- and post-tests and girls' (experimental and control) pre- and post-tests. The t-tests were used to determine whether any differences or changes occurred in the boys and the girls in the four measured creativity factors after the Jefferson Level Six class had experienced the outdoor education activities.

CHAPTER IV

PRESENTATION OF DATA

The purpose of this study was to determine whether outdoor education activities would increase the level of creative thinking of sixth grade children.

Data compiled from the scores of the creativity tests are presented in Chapter IV under five headings:

1. Differences Between the Two Classes Prior to the Outdoor Education Experiences.
2. Differences Between the Two Classes After the Outdoor Education Experiences.
3. Differences in the Children of the Experimental Class After the Outdoor Education Experiences.
4. Differences in the Children of the Control Class Not Having the Outdoor Education Experiences.
5. Differences Between the Boys in the Two Classes and Differences Between the Girls in the Two Classes After the Outdoor Education Experiences

Differences Between the Two Classes Prior to the Outdoor Education Experiences

Before the outdoor education experiences, the children in the experimental class were significantly different from the children in the control class for the factors of figural fluency and figural

flexibility. The t-values found were 2.24 for figural fluency and 3.43 for figural elaboration. The value required for the .05 level of significance was 1.678. These indicated that there was a significant difference within the two factors in favor of the children in the experimental class. The t-values for figural flexibility and figural originality showed no significant differences. Range of scores, means, standard deviations, and t-values for the experimental pre-test and control pre-test are in Table I.

Differences Between the Two Classes After the Outdoor Education Experiences

After the outdoor education experiences the children in the experimental class had no significant differences in the means for the four measured creativity factors. Whereas, the children in the control class had a significant increase in the means for figural originality and figural elaboration, but no significant difference in the means for figural fluency or figural elaboration.

The value required for the .05 level of significance was 1.678. The t-values for figural originality of 2.00 and figural elaboration of 6.47 showed there was a significant change within the two factors, however, the change was in favor of the children in the control class. Whereas, the children having the outdoor education activities had shown no significant gain in figural elaboration or figural originality.

The t-values had shown that neither the children in the experimental class nor the control class had any significant changes

Table 1

Significance of the Difference Between the Pre-Test Means for the Experimental and Control Classes on the Four Measures of Creativity

Creativity Measure	Range (low/high)		Means		Standard Deviations		t-Value[b]
	Exp.[a]	Control	Exp.	Control	Exp.	Control	
Figural Fluency	9/31	7/28	16.82	15.58	6.23	5.88	2.24*
Figural Flexibility	7/27	7/23	14.44	13.95	4.74	4.92	.81
Figural Originality	12/60	10/46	27.37	25.87	12.75	9.04	1.66
Figural Elaboration	7/110	28/68	65.79	61.12	25.42	23.46	3.43*

* Significant at the .05 level.

[a] Experimental and control classes.

[b] The value required for the .05 level of significance is 1.678.

in figural fluency or figural flexibility. Means and standard deviations for the pre- and post-tests between experimental and control tests are in Table II.

Differences in the Children of the Experimental Class After the Outdoor Education Experiences

No significant change was found in factors of figural fluency, flexibility, originality, or elaboration. The children in the experimental class had recorded a slight mean increase in figural fluency, flexibility, originality, and elaboration, however, none of the mean increases was significant.

The children in the experimental class having had the outdoor education activities did not record a significant gain in figural fluency, figural flexibility, figural originality, or figural elaboration.

The value required for the .05 level of significance was 1.703. The t-values for figural fluency at .45, figural flexibility at .36, figural originality at 1.27 and figural elaboration at .47 showed that there was no significant changes in the four factors of creativity. The children in the experimental class after having the outdoor education activities showed no significant increase in figural fluency flexibility, originality, and elaboration. Range of scores, means, and standard deviations for the experimental pre-test and experimental post-test are in Table III.

Table 2

Significance of the Mean Difference (Pre and Post Tests)
Between Experimental and Control Classes

Measure	Mean Change		Standard Deviation		t-Value[b]
	Exp.[a]	Control	Exp.	Control	
Figural Fluency	2.25	2.13	4.46	4.24	.20
Figural Flexibility	1.96	1.86	3.55	3.83	.19
Figural Originality	6.57	8.47	11.45	12.10	2.00*
Figural Elaboration	10.42	18.39	17.24	21.23	6.47*

* Significant at the .05 level.

[a] Experimental and Control classes.

[b] The value required for the .05 level of significance is 1.678.

Table 3

Significance of the Difference Between the Pre and Post Test Means for the Experimental Class

Measure	Range (low/high)		Means		Standard Deviation		t-Value[a]
	Pre	Post	Pre	Post	Pre	Post	
Figural Fluency	9/31	7/36	16.82	17.10	6.23	5.56	.45
Figural Flexibility	7/27	6/24	14.44	14.80	4.74	4.26	.36
Figural Originality	12/60	6/65	27.37	31.30	12.75	15.76	1.27
Figural Elaboration	7/110	16/128	65.79	69.13	25.42	28.11	.47

[a] The value required for the .05 level of significance is 1.703.

Differences in the Children of the Control Class Not Having the Outdoor Education Experiences

A significant increase was found in the factors of figural originality and figural elaboration. No significant change was found in figural fluency or figural flexibility.

The children in the control class had no outdoor education activities but the class experienced a gain in figural originality and figural elaboration. The experiences or set of circumstances which brought about the gains are unexplainable.

The value required for the .05 level of significance was 1.717. The t-values for figural originality at 2.35 and figural elaboration at 3.33 showed there was a significant increase even though the children in the control class had no outdoor education activities. There was no significant change in figural fluency or figural flexibility. Range of scores, means, and standard deviations for the control pre-test and control post are in Table IV.

Differences Between the Boys in the Two Classes and Differences Between the Girls in the Two Classes After the Outdoor Education Experiences

No significant change was found for the boys in the experimental class in the factors of figural fluency, flexibility, originality, or elaboration. In fact, the boys in the experimental class experienced a decrease in average means for three of the measured figural creativity factors. There was a slight gain in figural originality although the gain was not significant.

Table 4

Significance of the Difference Between the Pre and Post Test Means for the Control Class

Measure	Range (low/high)		Means		Standard Deviation		t-Value[a]
	Pre	Post	Pre	Post	Pre	Post	
Figural Fluency	7/28	7/24	15.58	15.56	5.88	4.48	.64
Figural Flexibility	7/23	7/21	13.95	13.76	4.92	3.83	.42
Figural Originality	10/46	10/64	25.87	31.32	9.04	12.40	2.35*
Figural Elaboration	28/108	29/120	61.12	73.08	23.46	25.50	3.33*

* Significant at the .05 level.

[a] The value required for the .05 level of significance is 1.717.

No significant change was found for the boys in the control class in the factors of figural fluency, flexibility, originality or elaboration. The boys in the control class experienced a slight increase in average means for all the measured factors: figural fluency, flexibility, originality, and elaboration, however, the increases were not significant.

A significant change was found for the girls in the experimental class in figural elaboration, however, there was no change in figural fluency, flexibility, or originality. The girls in the experimental class experienced an increase in average means for all the measured factors, however, the increases were not significant except that of figural elaboration.

A significant change was found for the girls in the control class in figural originality and figural elaboration, however, there was no change in figural fluency or figural flexibility. The girls in the control class experienced an increase in average means for the measured factors of figural fluency, originality, and elaboration, but decreased in figural flexibility. However, the increases in the measures of figural fluency and figural flexibility were not significant as compared to the significant increase in figural originality and figural elaboration.

The value required for the .05 level of significance for girls in the experimental class was 1.833. The t-value for figural elaboration at 2.321 had shown that there was a significant increase in figural elaboration for the girls having had the outdoor education activities.

The value required for the .05 level of significance for girls in the control class was 1.812. The t-value for figural originality at 2.142 and figural elaboration at 4.417 had shown that there was a significant increase in figural elaboration and figural originality for the girls having no outdoor education activities.

The girls experiencing outdoor education activities had no change in figural fluency, figural flexibility, or figural originality.

The girls experiencing no outdoor education activities had no change in figural fluency or figural flexibility.

The boys experiencing outdoor education activities and the boys in the control class had no significant changes in figural fluency, figural flexibility, figural originality, or figural elaboration. Average mean differences and t-values are in Table V.

Table 5

Significance of the Average Mean Difference Between the Pre and Post Test Means for the Boys in the Experimental Class, the Boys in the Control Class, the Girls in the Experimental Class, and the Girls in the Control Class

Measure	Average Mean Difference				t-Values			
	Boys		Girls		Boys		Girls	
	Exp.	Control	Exp.	Control	Exp.[a]	Control[b]	Exp.[c]	Control[d]
Figural Fluency	-0.833	0.083	2.500	1.091	0.779	0.052	1.387	0.944
Figural Flexibility	-0.444	1.083	1.800	-0.455	0.471	0.841	1.435	0.367
Figural Originality	2.778	5.250	5.900	8.182	0.862	1.362	1.701	2.152*
Figural Elaboration	-3.333	2.000	14.500	29.818	0.786	0.430	2.321*	4.417*

* Significant at the .05 level.

[a]The value required for the .05 level of significance is 1.740.

[b]The value required for the .05 level of significance is 1.796.

[c]The value required for the .05 level of significance is 1.833.

[d]The value required for the .05 level of significance is 1.812.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND IMPLICATIONS

The hypothesis in this study was that there would be an increase in non-verbal creative thinking abilities in the experimental group who experienced the experimental variable and no change in the control group who did not have experiences with the experimental variable.

Summary of Procedures

Two groups of sixth-grade pupils, one experimental with 30 children and the other control with 25 children, were used as the population of the study. Both groups were tested at the beginning of the experiment with the Torrance Tests of Creative Thinking, Figural A.

The experimental group experienced 13 outdoor education activities incorporated into units within the curriculum areas of social studies, science, art, and music. The control group had no outdoor education activities only their regular classroom routines. After 45 school days both groups were given the Torrance Tests of Creative Thinking, Figural B. The tests used in the study measured non-verbal creativity. No score of total creativity was obtainable.

Findings

Analyses of the test data obtained from this study, with the initial delimitations and limitations, revealed the following findings:

1. Outdoor education activities did not improve the level of measured creative thinking factors of the pupils in the experimental group.
2. The pupils in the control class had a significant increase in figural originality and figural elaboration.

3. Outdoor education activities had an effect in non-verbal creativity of girls in the experimental class. The girls had a significant gain in figural elaboration.
4. Outdoor education activities had no effect on non-verbal creativity of boys in the experimental class. The boys recorded a decrease in the four measured creativity factors.
5. The boys in the control class had no significant gains in the four measured creativity factors.
6. The girls in the control class had a significant gain in figural originality and elaboration.

Conclusions

Based on the findings of the study, it was concluded that the utilization of generalized outdoor experiences as a teaching medium does not increase the level of creative thinking of boys but is effective with girls as related to figural elaboration. Thus the hypothesized differences were not supported except for the one factor for girls.

Implications

The results of the study had shown that outdoor education activities did not improve the creativity factors of figural fluency, flexibility, originality, or elaboration for the children that experienced the outdoor education activities. However, one positive point appeared, the girls in the experimental class did record a significant gain in figural elaboration. Since the desired or expected outcome did not occur, one or any combination of the variables: time, setting, activities, or teacher may have affected the results.

Time. The children in the experimental class had 24 hours of outdoor education activities. The 24 hours were extended over one nine week reporting period of 45 days. Apparently the children needed more hours of exposure with the outdoor education activities to increase their creativity. The outdoor education program could be extended another nine week session or even into a completed school year to obtain the additional hours.

The outdoor experiences, as each were individually conducted, may have been too rushed. Since each activity was fairly structured and programmed into a subject's unit, the children went outdoors to experience an activity within definite time limits. The children were returned to the classroom immediately following the directed activity. Results may have been different had the children had more time in the activity and also time to leisurely reflect upon the surroundings, rather than returning to the classroom to adhere to the schedule of classroom deployment.

Significant gains may have been obtained by concentrating the hours of exposure with the outdoor education activities into one week. A resident camp experience of one week would actually give more hours to outdoor activities while concentrating the exposure into a shorter span of time.

Time is an important variable in making an effect on the intellect. Therefore, to determine how much time is needed to affect the measured creativity factors remains unknown, and the variable of time still needs more experimentation. The results may indicate that the boys need more time than the girls.

The following recommendations may have some measurable effect upon creativity gains:

1. Have no set time limits for each directed activity, but rather the activity be judged concluded whenever the interest by most of the children is no longer evident to the teacher.
2. Have a five day resident camp experience where most of the waking hours of the children could be spent on outdoor activities.
3. Allow each child to leave the activity whenever he feels he no longer wishes to participate.

Setting. The settings in which the outdoor activities were conducted may not have been motivating or stimulating to have an effect on the children's ability to react or to gain in creative thinking. However, the immediate school grounds, the neighborhood, and the community were the most available and convenient settings to conduct the outdoor activities. For a change one such setting might be an outdoor education resident camp.

A resident camp experience offers a complete change in the normal surroundings for most children, therefore, a marked change in the measured creativity factors may be obtainable through an outdoor education resident camp.

Much experimentation would be required to determine which outdoor setting has an effect on creativity.

The following recommendations may have some measurable effect upon creativity gains:

1. Whenever vegetative settings are necessary children living in predominate landscaped settings could be taken to natural settings.
2. Whenever vegetative settings are necessary, children living in predominate concrete, brick settings could be taken to landscaped or natural settings.
3. All children could be taken to a five day resident camp setting.

Activities. The outdoor education activities were borrowed from outdoor education textbooks and reference materials. The authors reported the activities to be educationally useful and stimulating thus recommending the activities for outdoor education programs. The authors never had claimed the activities would increase creativity. However, the authors seemed to imply that the activities could stimulate creativity.

The activities listed and used offered variety because the activities were thought to be the best to accomplish the objectives for each lesson. Variety was also thought to aid children in the measured creativity factors. The activities may have been less challenging and less stimulating than outdoor educators have thought. For a different approach, the children in the experimental class could have been given the opportunity to choose activities from a more comprehensible list and also encouraged to make up original activities to accomplish the purpose for going outdoors.

The activities were not selected for a directed experience to any I Q level. Rather it was believed that the activities could be

successfully completed by children with a wide range of I Q's.

It should also be noted that the experiences were not selected for a directed experience in creativity development. Perhaps if the activities were specifically directed toward creativity development, a different result would be obtained.

There is an on-going discussion of what is outdoor education--a method utilizing the outdoors, a setting where experiences can be carried out, or experiences subject-oriented. The outdoor activities used in the experiment fell into all the above categories, however, the majority of the activities would come under "method."

The following recommendations may have some measurable effect upon creativity gains:

1. The teacher for the experimental class could give the children more opportunities to plan and execute the outdoor activities rather than the teacher controlling the selection of activities.
2. No pre-planning, a spontaneous execution of an activity in the outdoors because the time, mood, and situation appear right for going outside.
3. The children could be given the opportunity to choose activities from a more comprehensible list compiled by the teacher.

Teacher. The teacher for the control class could have coached the children for the Post Test. Although this was highly improbable, the teacher for the control class agreed to cooperate with the experiment.

However, the gain in figural originality and elaboration for the children in the control class remained unexplainable.

The following recommendations may have some measurable effect upon creativity gains:

1. The researcher could select two classes and two teachers to participate in the experiment other than his own class. The researcher does not teach any of the classes nor does he participate with the children other than administering the creativity tests.

The task at hand remains to be more understanding in the use of tools, methods, and settings to foster creativity. Outdoor education, whether it be labeled a method or a setting, could be a facilitator to foster creativity.

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APPENDIX A

ANALYSIS OF THE TORRANCE TESTS OF CREATIVE THINKING

Use

Torrance cites the following uses:

1. Basic studies that will yield a more complete understanding of the human mind and its functioning and development.
2. Studies designed to discover effective bases for individualizing instruction.
3. Sources of clues for remedial and psychotherapeutic programs.
4. Assessing the differential effects of various kinds of experimental programs, new curricular arrangements or materials, organizational arrangements, teaching procedures, and the like.
5. As a means of becoming aware of potentialities that might otherwise go unnoticed. (32:4)

Administration and Evaluation

The figural and verbal tasks are presented in different booklets. There is an alternate form for each (A and B). The Torrance tests can be administered to groups above group 4 through graduate school, and individually as low as kindergarten: 45 minutes are necessary for one verbal test form and 30 minutes for one figural test form.

Administration of the tests is fairly easy: requiring the examiner to read the directions, set timing, establish good relationships with the examinee, and motivate subjects to perform at their best.

Scoring tests of this sort is difficult. Torrance developed an elaborate scoring guide, giving both rules and examples. Classroom teachers are able to agree rather well with Torrance's judgment of specimen papers, but only after attentive study of the manual. Familiarity with Torrance's concepts of creative thinking and its

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measurement is essential. The types of tasks chosen for the Verbal and Figural tests have been devised to be used together as well as independently of each other.

Verbal Tests

1. The Ask-and-Guess test presents a picture of a clown-like figure and the children are to list all the questions that occur to them about the picture, all the causes they can imagine for the situation shown, and all the consequences they can imagine to which this situation might lead.
2. The Product Improvement test presents a sketch of a stuffed toy elephant and the children are to list the cleverest, most interesting, and unusual ways they can think of for changing this toy elephant so that children will have more fun playing with it.
3. Unusual Uses test is a stimulus to invention. The children are to list as many interesting and unusual uses as they can think of for cardboard boxes.
4. Unusual Questions test measures divergent power. It asks children to list questions about cardboard boxes. Questions which would lead to a variety of different answers and might arouse interest and curiosity in others concerning boxes, and which people do not usually think about.
5. Just Suppose test is an attempt to elicit a high degree of spontaneity. The children are confronted with an impossible situation and asked to predict the possible outcomes from the introduction of a new or unknown variable.

Figural Tests

1. Picture Construction test requires the children to think and draw a picture in which the given shape made of colored paper is an integral part. They are to think up a title for it. Elaboration is encouraged to add ideas that will make the picture tell as complete and as interesting a story as possible.
2. Incomplete Figures test requires the children to add lines to the incomplete figures sketching some interesting objects or pictures. They are to make up an interesting title for each drawing. This test sets up in the children tensions to complete it in the simplest and easiest way possible. Thus, to produce an original response, he has to control his tensions and delay gratification of this impulse to closure.
3. Parallel Lines test requires the children to make objects or pictures from the parallel lines, and give the pictures or objects a name or title. This test taps the ability to make multiple associations to a single stimulus.

Evaluation for Each Response of the Tests is Based on the Following Factors:

1. Fluency - the number of relevant responses given minus the number of duplications and irrelevant responses.
2. Flexibility - the number of different categories into which the responses fall.

3. Originality - the frequency with which a response occurs. The less frequent a response, the more originality points it is given. It is heavily weighted on imagination and creative strength showing intellectual energy by being beyond what is learned, practiced, habitual, and commonplace.
4. Elaboration (figural form only) - the amount of detail given to a drawing to make it more complete of a construct.

The raw scores for each factor on each task are summed on the scoring sheet. The raw scores can then be converted into "T" scores as explained in the Norms-Technical Manual. The "T" scores have a mean of 50 and a standard deviation of 10. Torrance suggested the fifth grade normative scores for conversion of all scores which he feels is more than sufficient for the general needs of the majority of examiners. It is possible to judge the relative weakness and strengths of the children in relation to the normalized "T" scores.

Inter- and Intrascorer Reliability

An experiment was conducted during 1965-66 to determine the extent to which unselected classroom teachers can reliably score Verbal and Figural Forms A and B without any training other than individual study of the scoring guides. The mean Pearson product - moment coefficients between the scoring of trained scorers and untrained teachers for the figural tests were: Fluency, 96; flexibility, .94; originality, .86; and elaboration, .91. The mean reliability coefficients for the verbal tests were: fluency, .99; flexibility, .95; and originality, .91. These findings suggest that it is not necessary to have special training in scoring to assure reliable results for these tests. What is necessary

is that the scorer read and follow the scoring guide as precisely as possible, accepting the standards of the guide as a basis for judgment.

Test - Retest Reliability

Torrance reported that no conclusive or extensive studies have been made with all four of the complete batteries (Verbal Form A, Verbal Form B, Figural Form A and Figural Form B) being administered to the same individuals. The studies presented give coefficients of correlation for each of the three verbal and four figural scoring requirements that appear to be reasonably good. However, there is mention of studies where correlation was not found to be a high. Test - retest reliability for the most part is usually anywhere from .35 to .97.

Validity

According to Torrance the concept of an overall validity coefficient for tests of creative thinking ability is grossly inappropriate. A person can behave creatively in an almost infinite number of ways and there is a diversity of definitions of creativity therefore it would be impossible to provide users satisfactory evidence of validity. Torrance discusses the problem of validity within his frame of own reference.

Content Validity

Torrance admitted that these test tasks do not sample the entire universe of creative abilities but have been accepted because they do sample a rather wide range of abilities in such a universe. Torrance knew that the intercorrelations would be relatively low before he assembled these tasks into batteries. But these tasks were deliberately

chosen because it was believed that they call into play different parts of a universe of abilities that may legitimately be conceptualized as creative thinking abilities. In some cases, these decisions were based on factor analysis data. According to Torrance concent validity has been insured by the consistent and eliberate effort made to base and test stimuli, test activities, instructions, and scoring procedures on the best theory and research available.

Construct Validity

Construct validity is extensively covered in the Norms - Technical Manual discussing studies: involving children, involving high school youth, involving adults, of growth resulting from experiences in creative thinking and of preferred ways of learning. Some of these studies have involved simple correlations between the creativity test scores and other measures, while others have involved the comparison of the personality characteristics of persons achieving high scores on the tests with those who have low scores.

Concurrent Validity

Torrance and his associates have been able to find no generally acceptable criteria of concurrent validity. The following criteria are discussed in the Norms - Technical Manual: Peer Nominations, Teacher Nominations, Sales Productivity, and Educational Achievement.

Predictive Validity

The studies concerning predictive validity are of a more recent nature than most of the previous studies. Two studies by Torrance and

his associates are nearing completion. One of the studies by Erickson has much of the results in, and although it is premature, encouraging evidence is described in the Norms - Technical Manual.

APPENDIX B

OUTDOOR EDUCATION ACTIVITIES

Outdoor Experience No 1.

Date: September 21

Objective: Pace off (or measure off) and put a perimeter around an actual acre.

Procedures:

1. Allow the children to determine the school site that they think will determine an acre.
2. When site is selected, discuss how big the perimeters will have to be and how many sides it could have.
3. By pacing method (which class has already established) or using fifty foot tape establish perimeter and identify the perimeter in some way. The children could form the perimeter.
4. Interesting to note whether the actual size of an acre was larger or smaller than the children anticipated.

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Outdoor Experience No 2.

Date: September 22

Time: One (1) hour

Objective: Count the number of different species of plant life within a given acre, and their total population. Children visualizing diversity.

Procedures:

1. Impossible to count all the plants within an acre, therefore, the children will use a randomizing method called the "One Ten-Thousandth of An Acre Hoop" (see attached sheets).
2. Children working in groups, four to a group, made the hoops in class.
3. The same groups which made the hoops pick their counting area by throwing their hoop into the selected site.
4. They count the different species and population number within each species.
5. The children are exposed to the concepts of: Diversity and Random Sampling.

The One Ten-Thousandth of an Acre Hoop

The use of the 1/10,000 of an acre hoop can be the starting point for lessons in various curriculum areas. Even the development of the hoop offers students the opportunity to have a direct learning experience in the computation of the area, radius and circumference of a circle.

If it is within the capabilities of the students, have them figure the area and circumference of one ten-thousandth of an acre. If 43,560 square feet is the area of an acre, then the area of 1/10,000 becomes 4,356 square feet. By using the formulas, $A = \pi r^2$ and $C = 2 \pi r$, the circumference of the circle can be figured. Therefore:

$A = \pi r^2$	$C = 2 \pi r$
$4.356 = 3.14 r^2$	$C = 2 (3.14r)$
$1.387 = r^2$	$C = 6.28 (1.17771)$
$1.17771 = r$	$C = 7'\ 3.96"$ or $88\ 3/4"$

Lengths of clothes line wire can be cut to 88 3/4" and taped in a hoop. (Add an extra inch for overlap.) This circle can then be divided with twine into four quadrants.

ACTIVITIES: Ecology and Plot Study.

For a general survey of an area, divide the class into groups of five. Have the students toss their hoops on areas of the school groups or in a park. With a student working each quadrant and one recording the information, have them count the number of things they find. At this time it is not necessary to identify everything by name. Interest should be in numbers and varieties. Vegetation, animate and inanimate items should all be counted and classified. Later the class can compile and compare their samplings.

This study lends itself to the four principal concepts of Ecology (Diversity, Interrelationships, Adaptation and Change) as stated in the Grade Teacher, January, 1969. By becoming aware of the large quantity of small things which make up our environment, students can better understand what is meant by Diversity.

Through an awareness of Diversity, the students can begin to understand the Interrelationships of all things. Why were there more worms in one area? What was in that area that another area lacked? Because of the worms, was the soil any different? What possible difference does it make? What are the consequences of man's activities in the area?

After noting the differences and Interrelationships, students might begin to understand Adaptation and ask, "1. What attributes of this particular animal, insect or plant make it possible for it to live in this particular environment? 2. What aspects of this particular environment make it possible for this particular animal, insect or plant to live here?" (Grade Teacher, January, 1969, p. 112) Do plant roots spread out or go straight down? Why?

The fourth ecological concept, Change, can be discovered by conducting the hoop count in the fall and again in the spring. What obvious changes have taken place in the area? Trees cut down? Field cultivated? Grass mowed or paved? Count the items near the fall count and compare totals. Why have some plants diminished in number while others have increased? What happened to all the acorns and fallen leaves? What new plants and insects have come in?

ACTIVITY: Mathematics.

After tallying all the numbers of plants, animals, insects and non-living things, have the students project the number of varieties in an acre. Each group should total the four quadrants in their hoop and add four zeros. This would be the total for the acre if their hoop was exactly representative of the area. To get a more accurate picture, have the groups add all their totals, divide by the number of groups and add four zeros to each variety.

To aid the students in understanding the size of an acre, have them stand on the 90 yd. 27 inch line of a standard football field. The larger part of the field is equivalent to an acre. (A=lw: A=90 3/4 . 53 1/3 yds: A=4,840 sq. yds. or one acre) Consider the Louisiana Purchase where approximately 82,762,880 square acres of land was purchased for $15,000,000.00 or about eighteen cents per acre. Compare this cost with an acre of land in your area now. What is the percent of increase?

ACTIVITY: Language Arts.

Two areas of language arts which can be developed here are accurate reporting and creative writing. Recording the data collected from the count and reporting them to the class demands accuracy. Descriptions of the various items found in the hoop must be complete enough to later identify.

Creative compositions and tall-tales can be written about the area examined. A blade of grass telling why he is taller than the rest, a snail shell telling his life's story or an acorn reflecting on the

different directions his life might take are some of the ideas which may arise.

ACTIVITY: Conservation.

To demonstrate the problem of litter, have the students toss their hoops in a littered area around the school ground and have them pick up every scrap of trash in the circle. The trash can be weighed and the projected total of the amount of litter in the school grounds can be made. A weekly clean-up of a given area can lead to a yearly projection of litter accumulating just on the school grounds. What does it cost the school, town and state for litter clean-up annually?

As a graphic demonstration of how bad litter can be, secure permission to display the litter in the school lobby or a display case.

To demonstrate what litter can do to water, place the trash from one quadrant in a gallon jar partially filled with water. Close the jar and open it again after three days, a week, ten days and two weeks. What do the contents of the jar smell like each time? What physical changes have occurred in the litter? the water? What relevance does this have to the rivers and lakes that are now dying?

Printed by the Pennsylvania Outdoor Education Resources Center, The Pennsylvania State University's College of Health, Physical Education and Recreation.

Outdoor Experience No 3.

Date: September 23

Time: One (1) hour

Objective: Count the number and classify the different species of trees in the school grounds. Children visualizing diversity and classifying tree species.

Procedures:

1. Since the number of trees and different species are not many, randomization procedures will not be necessary. The children can take an accurate count.
2. The class is divided into four groups. Each group is assigned one-fourth of the work site.
3. They are to plan how they will cover the assigned area to accomplish their purpose such as: how to make a tally, how to make certain all trees are accounted for, how to identify the species.

Outdoor Experience No 4.

Date: September 30

Time: Three (3) hours

Objective: enjoying a nature walk in Byrd Park. Looking for signs of animal life. Practicing plant identification with Taxnomic keys.

Procedures:

1. Leave school at noon and hike to Byrd Park (approximately one and a half miles from the school).
2. While hiking look for evidence of good housekeeping by the township (along roads) and home owners (in their lawns)
3. Have a picnic lunch at the shelter.
4. The nature walk through the park with emphasis on: signs of animal life, plant identification, and geologic features, possible sites for a future plot study.
5. Hike back to the school for dismissal.

Outdoor Experience No 5.

Date: October 6

Time: One (1) hour

Objective: Instruction and practice in "shading on pencil or charcoal sketches.

Procedures:

1. The art teacher is teaching "shading" to the class.
2. While outdoors each pupil is to choose a natural phenomena on the school grounds or one within sight of the school grounds.
3. After choosing the subject matter each pupil is to sketch his subject in pencil or charcoal.

Outdoor Experience No 6.

Date: October 8

Time: Three (3) hours.

Objective: Seeing nature plant life, decorative floral garden arrangements, and exotic plant life at Phipps Conservatory. Touring a nature museum.

Procedures:

1. The class is to take a field trip to Phipp Conservatory to see the nature plant life exhibit, garden arrangements, and exotic plants display.
2. Bus leaves at noon and returns at 3:30 for dismissal.
3. After leaving Phipps Conservatory, the class will walk to the Nature Museum.
4. While driving to the Conservatory point out and briefly discuss the following points of interest:
   a. The Point: Where the Allegheny River and Monongahela River form the Ohio River. Point State Park and Fort Pitt.
   b. U. S. Steel Building: largest between Chicago and New York.
   c. J & L Steel Mill: signs of pollution.
   d. Mt. Washington: note the plant growth on the steep sides and observation decks.

Outdoor Experience No 7.

Date: October 13

Time: One and half (1½)hours

Objective: Setting up collection stations to gather air pollutants and spotting litter for a future clean up campaign.

Procedures:

1. Using the exhaust of an idling automobile, place a sheet of white oak tag or construction paper several feet away from the exhaust pipe to see how much pollutants collect on the paper. Discuss air pollution problems.
2. Then pupils are to place white cloth squares one foot by one foot at pre selected sites on the school grounds. The square are to be held in place by pegs.
3. While placing the cloth squares, the pupils are to make mental notes of the locations they spot litter.
4. The white squares will be gathered at the same time tomorrow (24 hour interval) to determine which site had the most air pollution and why.
5. After returning to the room the class will begin work on their posters for our anti-litter campaign for our school.

Outdoor Experience No 8.

Date: October 14

Time: Two (2) hours

Objective: Conduct a plot study in our school yard. (A similar study will be conducted at Byrd Park at a later date.) Gathering data on an open grassland environment.

Procedures:

1. The class will work from the following plan "Guide line and Suggested Activities for Plot Study Development."
2. Each pupil will have his own copy, but the pupil copy will contain only the activities section entitled "III Suggested Activities Involved in Plot Study."
3. Activities "A" and "B" are to be completed by cooperative effort on the part of the entire class.
4. Activities "C" has ten suggested activities within the plot. Activities 9 and 10 are to be done by each pupil. Activities 1 through 8 are to each be done by a committee. There will be eight committees. Each committee will choose one of the activities (1 through 8) and they will be responsible for its completion.

GUIDELINE AND SUGGESTED ACTIVITIES FOR PLOT STUDY DEVELOPMENT

I. Definition of a Plot Study

The plot study is a method of teaching which involves the selection of a specific geographic area to provide the students with an opportunity to directly apply and experience concepts learned within the classroom curriculum; and to introduce those elements of the curriculum which can best be taught in the out-of-doors.

II. Planning Elements

A. Criteria for Plot Site Selection

1. Access to the school
2. Safety considerations
3. The site should contain a variety of opportunities for discovery.
4. Should be only large enough for the children to thoroughly study the elements of the plot in an allotted amount of time.
5. Relationship of one plot to another -- the plots should be close enough to each other to allow for adequate guidance and supervision by the teacher.

B. Time Considerations

The over-all time spent on a plot study will be determined by the number of areas to be introduced or reinforced by this method. The amount of time can vary from only one intensive experience to a study that evolves over a period of weeks or months. The time allotted for each visit to the site should meet each specific

objective, with each student being assigned to a specific task. If more time than required is given to meet an objective at the site, discipline problems may arise which could detract from the overall value of the study. Conversely, too little time spent on the plot may not allow for the realization of these objectives.

C. Equipment

An inventory of school equipment should be compiled so that the teacher may determine what tools are available for the study. Equipment that is not available in the school may be obtained from the local high school, county office of education, or from other community resources. The teacher should familiarize himself with the type and use of the equipment available. Some tools may be developed by the students as part of their learning experience.

D. Use of Local Resource Persons

Local resource persons, including the state forester, game warden, county agent, and other knowledgeable persons, may assist in guiding segments of the study. Resource persons should direct the students in discovery, rather than just lecturing on some topic.

E. Reference Materials

An activity that could coincide with the plot study is the collection of reference materials from libraries, state agencies, or from other local sources. Refer to the attached bibliography.

III. Suggested Curriculum-Oriented Activities Involved in Plot Study

The following activities are suggested areas to be studied on the plot and are not intended to be inclusive of all potential study areas.

The orientation of the activity to the curriculum remains at the discretion of the teacher.

A. Orienting the Plots

1. Relate study area to a local map
2. Plot location on maps
   a. Discuss topographic, road, contour, and relief maps
   b. Discuss contours, elevation, scale, azimuth, longitude, and latitude

B. Determining the Boundaries of the Plot

1. Estimating boundaries and physical features
   a. Pacing boundaries -- compute square feet
   b. Determine the physical characteristics of the land (topography and slope) -- clinometer and sighting level
2. Measuring the boundaries
   a. Introduce measuring tools -- ruler, yardstick, metric stick, tape measure, trail wheel, pedometer, etc.
   b. Determine longitude -- sextant and clinometer

C. Activities Within the Plot

1. Word hunt
   a. Inventory of nouns found on the plot
   b. List the adjectives related to these nouns (size, shape, color, texture, smell)
   c. Action words (wind, tree movement, water, etc.)
   d. Develop sentences using these nouns
   e. Paragraphs describing objects using parts of speech found in word hunt

2. Mapping the plot
   a. Select a suitable scale
   b. Determine the location of features on the plot using estimation or measurement techniques.
   c. Discuss ratio, proportion, and percentage of features to each other -- hypsometer, diameter tape, biltmore stick
3. Soils and geology
   a. Sample -- construct profile
   b. Perculation test
   c. Run-off test
   d. Soil formation and composition
   e. Erosion
   f. Weathering of rocks
   g. Identifying rocks and minerals -- hardness, color, texture, etc.
   h. Relate to geological map (see enclosed map)
   i. Water table
4. Plant ecology
   a. Discuss life processes in plants -- growth, respiration, reproduction, assimilation, circulation, and support
   b. Identification
      1) Plant parts
      2) Classification appropriate to grade level
      3) Identify specific plants -- use of keys
   c. Plant succession

5. Animal ecology
   a. Same as (a) and (b) for plant ecology
   b. Evidence of animals present -- homes, tracks, droppings, etc.
6. Water ecology
   a. Water cycle
   b. Identify plants, animals, insects, and microorganisms
   c. Effect of ground and canopy cover
   d. Development of streams
7. Weather
   a. Discuss weather concepts -- air pressure, temperature, wind, clouds, precipitation
   b. Introduce weather instruments
   c. Discuss relationship of weather and climate to items found on each plot
8. Local history
   a. Evidence of previous land use -- agriculture, timber
   b. Evidence of previous ownership, Indian artifact
   c. Pioneer crafts
   d. Survival techniques
9. Nature crafts
   a. Collect material from plots
   b. Collage, surigrami, mobiles, weaving, rope making, plaster casting, sand casting, and painting

10. Sight improvement

    a. Discuss best use of the resources of the lots

    b. Discuss methods of improving plots

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Outdoor Experience No 9.

Date: October 16

Time: One and a half (1½) hours

Objective: Conduct a litter campaign for the school. Pass out "Litter Posters" to each room (made by the children), collect litter from school grounds, and bundle and tie the collected litter for display in main school entry.

Procedures:

1. Committees have been formed and they have all the details for the clean up such as: Bringing in plastic bags, deciding which committee goes where to collect, where to bring the bags of trash for display, and where posters are to be displayed.
2. Following the clean-up Mr. Smith, public relations officer for Alcoa and a pupil's father, will show a film and talk to the class at three o'clock.

Outdoor Experience No 10.

Date: October 21

Time: One and a half (1½) hours

Objective: Practice on the use of pastels for outdoor scenes.

Procedures:

1. The art teacher is teaching the use of pastels.
2. While outdoors each pupil is to choose a scene or object he wishes to paint (reproduce) by using pastels.

Outdoor Experience No 11.

Date: October 22

Time: One and a half (1½) hours

Objective: Using natural materials to fashion into musical instruments.

Procedures:

1. Children are to search in the school grounds for natural materials that they can bring back to the music room to construct their musical instrument (string, wind, or percussion).
2. The instruments are to reproduce a sound. The music teacher will use them in his class for his instrumentation unit.

Outdoor Experience No 12.

Date: October 29

Time: Three and a half (3½) hours

Objective: Conduct a plot study in Byrd Park. Gathering data on a woodland environment.

Procedures:

1. See outdoor experience No 8 and follow the procedures.

Outdoor Experience No 13.

Date: November 4

Time: Three (3) hours

Objective: Seeing actual conservation practices in use. Talking to people that have a concern for conservation.

Procedures:

1. The class is to visit and tour the Marchezak Dairy Farm in Washington County.
2. The owner and soil Conservationist are to show the class the buildings, stock, and acreage.
3. The class is to see and hear about:
   a. good farming practices and management.
   b. conservation practices employed and why.
   c. how milk is taken from the cow and readied for shipment.
   d. how cows are cared for.

APPENDIX C

EXPERIMENTAL CLASS - CLASS RECORD SHEET: RAW SCORES AND *t-SCORES FOR FIGURAL TEST A (PRE) AND B (POST)

Sex	Raw Scores								t-Scores							
	Fluency		Flexibility		Originality		Elaboration		Fluency		Flexibility		Originality		Elaboration	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
M	16	20	14	15	30	21	87	103	39	44	45	45	56	52	63	64
M	13	11	12	10	22	48	22	41	35	30	42	35	45	95	33	38
M	28	21	23	18	47	57	50	33	57	45	63	50	75	100	45	35
M	31	23	27	21	60	49	47	52	60	49	70	58	91	97	44	43
M	12	12	11	12	21	20	43	81	34	32	40	39	44	50	42	55
M	20	20	16	18	36	44	54	62	45	44	50	50	63	90	47	48
M	15		11		17		66		38		40		40		53	
M	19	13	18	11	42	36	53	42	44	33	54	37	70	77	47	39
M	21	19	16	14	32	18	110	100	47	42	50	43	58	47	74	63
M	22	19	19	16	40	65	75	54	48	42	55	47	68	100	57	44
M	9	16	9	15	17	20	53	43	29	37	37	45	40	50	47	39
M	14	14	14	12	20	15	7	16	37	34	45	39	43	43	25	29
M	20	15	18	15	39	27	62	52	45	35	54	45	67	62	51	43
M	18	19	16	18	26	23	105	89	42	42	50	50	52	55	71	58
M	19	14	16	11	29	24	87	68	44	34	50	37	55	65	63	50
M	23	22	17	21	40	34	63	40	49	47	52	58	68	74	52	38
M	16	24	16	22	19	52	53	39	39	50	50	60	42	100	47	38
M	10	14	10	12	17	19	44	64	30	34	39	39	40	49	43	48
M	22	22	18	21	34	44	98	74	48	47	54	58	60	90	68	52
F	9	16	7	12	16	15	58	103	29	37	33	39	39	43	49	64

APPENDIX C (continued)

F	9	12	8	12	13	6	73	78	29	32	35	39	35	29	56	54
F	30	36	22	24	53	54	94	128	59	69	60	64	83	100	66	74
F	11	15	11	14	14	16	52	62	32	35	40	43	37	44	46	48
F	10	15	8	14	15	26	52	66	30	35	35	43	38	60	46	49
F	18	19	15	16	25	31	103	125	42	42	48	47	50	69	70	73
F	13	21	13	16	12	23	91	116	35	45	44	47	34	55	64	69
F	18	7	13	6	20	20	58	40	42	24	44	25	43	50	49	38
F	10	15	10	14	21	54	101	87	30	35	39	43	44	100	69	58
F	12	9	11	8	17	20	47	69	34	27	40	30	40	50	44	50
F		12		10		41		73		32		35		85		52

* Computed from Torrance's Norms--Technical Manual.

APPENDIX D

CONTROL CLASS - CLASS RECORD SHEET: RAW SCORES AND *t-SCORES
FOR FIGURAL TESTS A (PRE) AND B (POST)

	Raw Scores								t-Scores							
Sex	Fluency		Flexibility		Originality		Elaboration		Fluency		Flexibility		Originality		Elaboration	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
F	17		16		31		74		40		50		57		57	
F	13	12	13	11	34	29	98	120	35	32	44	37	60	65	68	71
F	17	21	15	16	24	30	49	109	40	45	48	47	49	67	45	66
F	15	14	15	12	23	47	59	94	38	34	48	39	47	94	50	60
F	8	13	8	10	18	15	47	90	28	33	35	35	41	43	44	59
F	13	17	12	13	18	31	31	90	36	39	42	40	41	69	37	57
F	10	18	8	16	12	35	70	76	30	40	35	47	34	75	55	53
F	20	18	18	11	38	38	53	90	45	40	54	37	65	80	47	59
F	22	18	21	16	34	38	39	51	48	40	59	47	60	81	40	43
F	19	17	17	16	25	23	43	29	44	39	52	47	50	55	42	34
F	13	11	13	11	20	19	60	87	35	30	44	37	43	49	50	58
F	20	23	18	21	22	53	28	69	45	49	54	58	45	100	35	50
F		11		10		27		47		30		35		62		41
M	9	13	8	13	23	32	48	45	29	33	35	40	47	70	44	40
M	16	22	14	19	26	38	41	47	39	47	45	53	52	80	41	41
M	13	15	10	13	10	30	37	71	35	35	39	40	39	67	39	51
M	7	7	7	7	19	10	46	39	27	24	33	28	42	35	44	38
M	15	14	12	15	31	30	108	108	38	34	42	45	57	67	73	66
M	13	19	11	18	17	48	83	65	35	42	40	50	40	95	61	47
M	13	17	12	14	30	26	86	88	35	39	42	43	56	60	62	58

APPENDIX D (continued)

M	10	12	10	11	21	25	85	61	30	32	39	37	44	59	62	47
M	10	11	9	11	15	14	40	64	30	30	37	37	38	42	41	48
M	27	24	22	21	35	33	62	57	55	50	60	58	62	72	51	45
M	28	15	23	14	43	28	105	108	57	35	63	43	71	64	71	66
M	26	19	23	18	46	64	75	87	54	42	63	50	74	100	57	58
M		8		7		20		35		25		28		50		36

* Computed from Torrance's Norms--Technical Manual.